ENERGOPTIONS

OVERVIEW PAPER

INSTITUTIONAL SECTOR

Educational

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1. INTRODUCTION

The Canadian educational sector is large and diversified, consisting of both primary and secondary schools as well as colleges and universities. Although aggregated national energy consumption and cost data are not currently available for the sector as a whole, many school boards and individual colleges and universities have established and are maintaining energy data bases for their own internal energy management use. These available data indicate that the sector is, in general, a large user of energy. Annual (1982) energy expenditures by individual educational institutions ranges from tens of thousands of dollars for small schools to more than eight million dollars for a large university campus. Even when annual energy costs are determined on a "cost per square metre basis", there remains wide variation in costs. Some of the factors affecting the variation in energy consumption and costs between institutions include size, climate/location, facilities, use patterns, and age.

2. OPTIONS:

The identification of comprehensive energy management options is, as implied above, site-specific. Nonetheless, experience to date has served to identify four broad areas of opportunity for energy cost savings. These are:

- **'Housekeeping Measures'** - "Quick-fix" measures such as establishing administrative responsibility for energy consumption within the institution, introducing employee training and awareness programs, modifying facility-use scheduling, improved equipment maintenance and operation procedures, de-lamping, etc. can provide immediate and low-cost savings.

- **Building Structures** - Upgrading the thermal efficiency of buildings through increasing insulation levels, and reducing air leakage (weatherstripping, caulking, etc.) can provide significant savings.

- **Mechanical and Electrical Systems** - In many cases, modifications to mechanical and electrical systems can result in very substantial savings. An extensive range of measures exist; generally site-specific assessment by a qualified consulting engineering firm is necessary. Some of the possible options in this area include:

  - re-instating proper operation of heating, ventilation, hot water and air conditioning equipment e.g., night set-back, proper temperature settings, reduced outside air quantities, etc.

  - upgrading or replacing inefficient heating, air conditioning, hot water and lighting equipment with new high-efficiency models

  - computer control and monitoring of energy using systems

  - installation of heat recovery systems on combustion, dehumification, ventilation or air conditioning equipment

- **Alternative Fuels** - If a local supply of wood is available, energy costs can be reduced by replacing conventional fuel heating and hot water systems with wood, wood-chip or wood residue boilers or furnaces. In certain applications, heating costs can also be reduced by supplementing conventional fuels with heat pumps or solar heating systems.

3. CREDA DEMONSTRATIONS

The projects assisted by the Federal/Provincial Conservation and Renewable Energy Demonstration Agreements (CREDA) outlined below provide a sample of the many options for reducing energy consumption and/or costs in the educational sector. Although these projects by no means represent the full range of possible options, they do provide tangible evidence of

the very significant cost savings that can be realized in the educational sector, as well as providing practical installation and operation experience.

The demonstration projects contained in this ENEROPTIONS package are:

MAN 39 ENERSCHOOL Retrofit Program

Under this major program, 20 schools were retrofitted and a manual was produced to assist school managers in assessing energy consumption and introducing efficiency measures. The twenty schools received complete energy audits. Major retrofits were undertaken on two schools and minor retrofits on the remainder. Annual savings at individual schools averaged over $10,000 with average paybacks of under two years.

MAN 40 Remote Computerized Energy Management - Manitoba

Energy consumption in the Minnedosa district school system was monitored and controlled using a remote computer hooked up to each school. Over 100 Manitoba schools are now in the process of implementing retrofit measures and connecting to remote computers. To date, savings averaging 40% had been realized for both natural gas heated and electrically-heated buildings.

ONT 29 Exterior Insulation Retrofit - Kingston, Ontario

A sixteen-storey residence building, the John Orr Tower, at Queen's University, was retrofitted on the exterior with 3 inches of extruded polystyrene insulation and covered by steel cladding in order to reduce heat loss and rectify a water penetration problem. Annual energy savings were about 28%.

ONT 48 Automatic Wood-Fired Boiler - Grenville Christian College, Brockville, Ontario

A large automatic wood-chip boiler was installed at Grenville Christian College to provide all space and hot water requirements. The savings realized by the college are $75,000 per year. They have planted poplar to provide for their requirements in perpetuity.

NB 10 Modifications to Wood-Chip Boiler - Maritime Forest Ranger School, Fredericton, New Brunswick

The existing wood-chip boiler system was modified and updated to improve efficiency, reliability and safety and to expand the range of cull wood it could use. Wood costs have thus been cut by 65% per year.

YUK 17 Pelly Crossing Wood-Chip Furnace Project - Pelly Crossing, Yukon

Space heating and domestic hot water for the community's new 1,300 m^2 school is provided by an automatic-feed, wood-chip boiler. Fuelwood for the boiler is harvested locally. Savings are $11,425, or 60% of the cost of operating a conventional, oil-fired system.

NB 41 University Energy Efficient Retrofit - Mount Allison University, Sackville, New Brunswick

A comprehensive energy management program was initiated at Mount Allison University including building upgrading, heat recovery, computer control, improved lighting and insulation of steam lines. Comfort levels were greatly improved and annual energy savings were over $157,000 per year.

NB 54 Wood Residue Fuelled Boiler - University of New Brunswick-Fredericton, New Brunswick

A large wood-fired boiler was installed, under an innovative financing arrangement, at the district heating plant which serves the entire UNB-Fredericton Campus, two apartment buildings, and a large 485-bed hospital. Annual operating savings in the range of $820,000 are being realized as the contribution to total heating requirements is over 70%.

REC 1 Arenas and Curling Rinks

Energy retrofits in 12 community arenas and curling rinks across Canada saved as much as 55% annually. The range of costs and savings associated with individual measures are detailed.

REC 3 Large Recreation Centres

Savings of 20% to 40% were achieved in four large multi-purpose facilities. These measures included: low-cost saving techniques, infiltration reduction, heat reclaim savings and control via the use of a microprocessor.

Many other projects of interest have been undertaken. Contact your nearest federal or provincial energy office to learn more about nearby projects or those similar to yours.

4. LESSONS LEARNED

Based on these CREDA demonstrations and other examples of energy consumption and cost reduction in the educational sector, the following lessons were learned.

Start-up. The establishment of administrative responsibility for energy consumption within the institution is a critically important aspect of any successful energy management program and should be undertaken at the outset of the program.

Low-cost vs. Comprehensive Approaches. Relatively simple "housekeeping" measures can provide significant savings for low capital investment. However, savings of 30% and more can be realized by implementing comprehensive retrofit and energy management measures in educational institutions.

Computer Controlled Systems. Start-up problems are frequently experienced during the commissioning of computer-controlled systems unless metering devices and computer hardware/software are thoroughly checked. Similarly, operators must fully understand how the system works and adhere to its operating guidelines.

Wood-fired Heating Systems. The space heating and hot water needs of many educational institutions can be met using wood-fired heating systems provided that reliable and economic sources of wood supply are available. An important caution when using large-scale residue wood-fired heating systems is that they can be susceptible to fuel handling and other problems if not properly designed and operated.

Swimming Pool Retrofit. Heat recovery from humid air in swimming pool buildings appears to be cost-effective only in large swimming complexes. Other pool retrofit measures, such as pool blankets and better control strategies, are cost effective in any size pool.

5. NEXT STEPS

Should you pursue a similiar initiative to those outlined above or discussed in greater detail in the ENEROPTIONS Case Studies enclosed, several "next steps" are suggested below.

- Establish administrative responsibility for energy consumption in your educational institution. It is recommended that this responsibility be placed with senior personnel. Depending on the scale of the educational institution, the establishment of an energy management committee consisting of technical and financial personnel may also be warranted.

- Invest in an energy audit before specifying the retrofit measures to be carried out. The "Resources Available" section (see page 9) presents several available options for securing an energy audit. Depending on your circumstances, the cost for this service can be minimal, but as previously emphasized, the benefits, in terms of financial return, can be significant.

- After carefully identifying the retrofit measures and/or heating system changes which are most advantageous to you, obtain cost quotations from at least two or three experienced and qualified contractors. Again, the experience of personnel involved with the demonstrations contained in this ENEROPTIONS package will be a valuable asset. Further contractor selection assistance is available from some of the "Resources Available" listed in the following section of this overview.

- If a wood-fired boiler is being considered, a reliable long-term supply of wood, wood waste, wood-chip or sawdust fuel must be obtained. A written guarantee of delivery and price should be obtained, and the supplier should be ready to enter into a long term contract. An experienced wood-burning equipment contractor should also be approached and asked to provide information on wood storage, feeding, and burning equipment and to accurately size the equipment for the reduced heat load. Experience with large-scale wood handling equipment is essential.

- If capital financing is a problem, then the possibility of innovative financing should be considered. Savings Financing (SF) also known as Energy Management Performance Contracting, is an innovative business arrangement where a significant portion of the project risk, including financial, technical and operating risk, is transferred from the energy user to another party. The firms offering these services, known as Energy Service Companies (ESCo's) typically will carry out walk-through and detailed audits, undertake design and specifications, purchase and install the equipment, maintain and monitor the equipment, and train in-house staff. Since ESCo's intend to recover their investment through the dollar value of the energy savings stream, the provision of quality services is a priority.

6. RESOURCES AVAILABLE

Technical reports are available free of charge for most of the CREDA projects listed above. Addresses of appropriate contacts for follow-up, including equipment suppliers and system designers, are listed at the end of each of the attached ENEROPTIONS Case Studies under the "Further Information" section.

The departments or ministries of energy and/or education in each province or territory have information on energy conservation and may have assistance programs. Check your government directory for appropriate contact people.

The Conservation and Renewable Energy Offices (CREOs) of Energy, Mines and Resources Canada in each province and territory have information on federal demonstrations, and other forms of assistance. Check the back of the attached file folder for the office in your area.

Contact the federal government office below for information available on the Post-secondary Education Task Force.

Commercial Energy Task Force Program
Energy Conservation and Oil Substitution Branch
Energy, Mines and Resources Canada
580 Booth Street
Ottawa, Ontario
K1A 0E4
(613) 995-9447

Information on qualified engineering firms in various areas of specialization and the "Recommended Procedure for the Selection of an Engineer to Provide Professional Services" can be obtained from:

a) The Association of Consulting Engineers of Canada
Suite 616
130 Albert Street
Ottawa, Ontario
K1P 5G4
(613) 236-0569

b) The Consulting Engineering Organization in each province.

Information on innovative financing arrangements can be obtained through the government departments listed above and/or by contacting:

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Energy, Mines and Resources Canada
580 Booth Street
Ottawa, Ontario
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